

and all crops are doing well, although the lack of late rains requires more irrigating. Everything promises well for the farmers and fruit raisers.—*S. H. Gerrish.*

Santa Cruz.—Ninety-two per cent sunshine; a very delightful month; no fog, very few windy days. Streams are quite low on account of lack of late rains.—*W. R. Springer.*

Shasta.—Total precipitation for season 39.36 inches. High winds have prevailed nearly the whole of the month.—*Dr. Thos. J. Edgecomb.*

Sierraville.—More wind this month than usual.—*C. D. Johnson.*

Squirrel Inn.—Winds during the summer are very variable; we are so located that it is a hard matter to tell definitely just what quarter they come from; this year they blew invariably from the west and south.—*A. D. Frantz.*

Willows.—The month, as a whole, may be considered cool, with a maximum above the last few years. The yield of grain is good.—*M. T. Harrington.*

NOTES ON THE RIVER CONDITIONS IN THE SACRAMENTO WATERSHEDS DURING JUNE, 1910.

The Sacramento Watershed.—Not since the records have been kept by the Weather Bureau, and probably for many years previous to the gaging of the rivers, have the streams of this watershed been so low during the month of June. This has been particularly true of the Sacramento River between Walnut Grove and the limits of navigation, where the stages averaged from 3 to 9 feet below the June normal.

At Colusa, Knights Landing, and Sacramento City, the average gage readings were 2.5, 2.8, and 3.0 feet, respectively, lower than the lowest ever previously recorded during any June. In the upper Sacramento, north of Red Bluff, while unusually low water prevailed, the departure from the normal was not so marked as in the navigable part of the stream.

Throughout the drainage area of the Feather-Yuba watershed there was a rapid diminution in the run-off of all mountain feeders, and there was a marked deficiency in the usual water supply of both streams at the close of the month. The North and Middle Forks of the Feather, and the North Fork of the Yuba, and all radiating forks thereof, carried less water at the end of June than, according to reliable information, for any previous June during the past 40 years. In some cases, notably, the numerous forks of the Yuba River above Downieville, the streams were lower than have ever been known at any previous time.

The American River was probably the last water course of any importance in the Sacramento River system to respond to the general shortage in the seasonal precipitation, due, no doubt, to the fact that the snow in the high altitudes drained by the feeders of this stream remained longer on the ground than in any other part of the northern Sierra. This river, however, began receding on the 1st of the month, and its at close carried less water than for any corresponding period of which there is a record, and its average was 0.8 foot lower than in 1908, the lowest previous June average.

During the last decade of the month the scarcity of water was recognized by the various water-supply companies, all of which have cautioned consumers as to the necessity of being economical in the use of water, and some companies have already begun drawing from their impounded reserves. In the case of the South Yuba Water Company the tapping of their reserves in the lakes was begun on June 13, more than a month earlier than usual; and it is estimated that this reserve will be practically exhausted by the 1st of October, and that many mines will be obliged to suspend operations, and fruit ranches will be entirely out of water for irrigation before the beginning of the rainy season.

Conditions, with respect to low water, are also becoming perplexing in the Sacramento River above Sacramento City, as many new sand bars have begun to form and old ones are becoming daily more prominent, making navigation difficult.

The San Joaquin Watershed.—There was a notable absence of the usual June rises throughout this watershed, and the rivers generally were as low or lower than during the corresponding month of 1908, when abnormally low stages were recorded.

In the tributaries of the San Joaquin the low water of June 1908, was equaled in the Merced River and exceeded in the Tuolumne and the Stanislaus rivers. In the Calaveras River, which usually goes dry during the late summer or early fall, there was practically no water at the close of the month, the stream having ceased discharging into Mormon Slough as early as May 11.

At Merced Falls the Merced River was 0.8 foot, at Jacksonville the Tuolumne River was 2.6 feet, and at Electra the Mokelumne River was 1.0 foot below the June average. The San Joaquin River itself was somewhat higher than during the low water of June, 1908, but with this exception it was much lower than during any corresponding month of which there is a record. At Pollasky, Firebaugh, and Lathrop, the San Joaquin River averaged 2.0, 2.8, and 3.0 feet, respectively, below the June average.

As the snow has practically disappeared from the southern Sierra all streams in the San Joaquin drainage basin will probably reach the summer low-water mark much earlier this season than usual.

SNOWFALL AT SUMMIT, CAL.

By Prof. A. G. McADIE.

I have been informed by Prof. George Davidson that in the season of 1868-9 the engineer in charge of construction of the Central Pacific Railroad, Mr. Judah, reported a seasonal depth of snow in the neighborhood of 60 feet. It is not known whether this can be definitely ascertained, since all the records of the railroad company on file at San Francisco were destroyed by the fire of April, 1906. Records of the depth of snow were maintained by the various station agents beginning with the winter of 1870. After the disaster referred to above all available records at the station itself were obtained and these, with duplicate records obtained from the Central Office and the tables previously published in the *Climatology of California*, have enabled us to construct a table showing the seasonal depth for a period of 40 years. This probably constitutes the longest period of snowfall observations in our country. A discussion of the record is of interest during the present month, because of the early disappearance of the snow and the probability of extreme low water in the watershed of the American River and its tributaries. A similar table was prepared for Prof. J. N. Le Conte, in 1908, and used as the basis of his article upon Snowfall in the Sierra Nevada, published in the *Sierra Club Bulletin* of June, 1908. The particular subject of interest in this paper was the possibility of predicting the probable date of disappearance of the snow, with a view of determining when travel would be safe through the mountains. Different seasons vary so widely that passes which may be attempted at the end of June one year are entirely out of the question even at the end of July in some other season. Professor Le Conte attempted to give the average rate of melting and to show the relation between this and travel possibilities. He published 11 plats showing the depth of snow on the ground for 11 different years. He finds in each of these an extremely irregular curve up to March, with high "peaks," representing storms. After the end of March the curve is fairly smooth. Averaging the curves for 10 years, he gets one which can be considered as showing the mean depth of snow on the ground at Summit. This curve is quite regular throughout, rising gradually to a maximum of 129 inches on March 26. The descending portion he calls "The curve of mean rate of melting." Averaging the depth of snow "by simply taking the sum of such snow as is on the ground at a given date and dividing by 10, and filling in zeros for such years as may have bare ground at the date in question, we get the curve ABCD, see fig. 1. This curve will evidently extend as far as the latest date at which we find snow in the record, viz, July 14, 1907. This does not give the correct rate of melting, however, beyond the date where the first curve touches zero, viz, April 23, 1898. In

order to get the curve showing the true rate of melting, we must find the average date at which snow is of a certain depth. For example, we find that the mean date at which all snow is off the ground at Summit is May 26; the mean date at which it is 20 inches deep is May 10, etc."

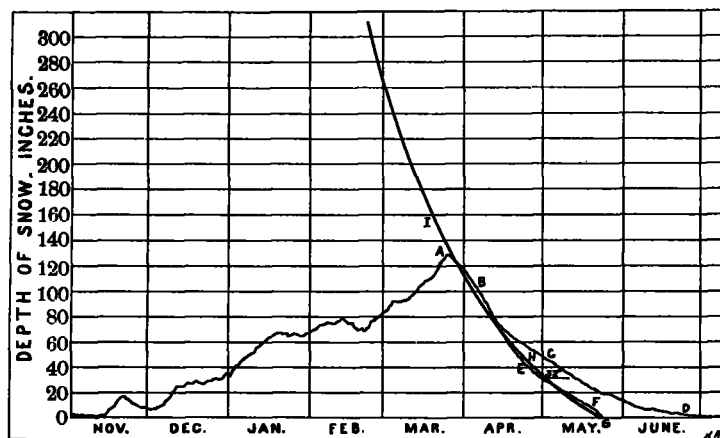


FIG. 1.

In this way Professor Le Conte obtained a curve as shown in the diagram, marked ABEFG, and disregarding small irregularities

calls the smooth curve IHG, the mean curve of melting at Summit Station. The actual curve of melting for any year may be compared with the mean curve, and if it falls below the mean for the most part the season will probably be a dry one, or in other words travel in the mountains will be possible at a much earlier date than during a year when the actual curve of melting rises above the mean.

Some inaccuracies were found in the table of total snowfall as originally furnished by this office and the revised and corrected table is given herewith:

Seasonal snowfall at Summit, Cal.

Elevation, 7,017 feet; latitude, 39° 19' N.; longitude, 120° 10' W.

Winter of—	Snowfall.	Winter of—	Snowfall.	Winter of—	Snowfall.
	<i>Inches.</i>		<i>Inches.</i>		<i>Inches.</i>
1870-1.....	300	1884-5.....	202	1897-8.....	262
1871-2.....	550	1885-6.....	462	1888-9.....	481
1872-3.....	334	1886-7.....	422	1899-1900.....	406
1873-4.....	200	1887-8.....	345	1900-1901.....	440
1874-5.....	284	1888-9.....	261	1901-2.....	373
1875-6.....	525	1889-1890.....	776	1902-3.....	407
1876-7.....	178	1890-1.....	335	1903-4.....	434
1877-8.....	341	1891-2.....	380	1904-5.....	375
1878-9.....	446	1892-3.....	634	1905-6.....	514
1879-1880.....	783	1893-4.....	511	1906-7.....	602
1880-1.....	154	1894-5.....	685	1907-8.....	340
1881-2.....	402	1895-6.....	544	1908-9.....	442
1882-3.....	299	1896-7.....	560	1909-10.....	342
1883-4.....	482				